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(54) Improved heat transfer apparatus

(57) Proposals have been made for securing gaskets to heat transfer plates by means of projections on the gasket passing through apertures in the plate. In the present invention, a gasket extends laterally outward beyond its gasket recess and has an upwardly extending ridge (9) cooperating with a downwardly facing recess on the adjacent plate, and projections are provided below the ridge (9) and pass through apertures (12) in the plate which are outside the gasket recess. The outer wall of the gasket recess laterally undulates in this region, the apertures lying between the wider portions of the recess. The undulating region alternates with a straight narrower region.

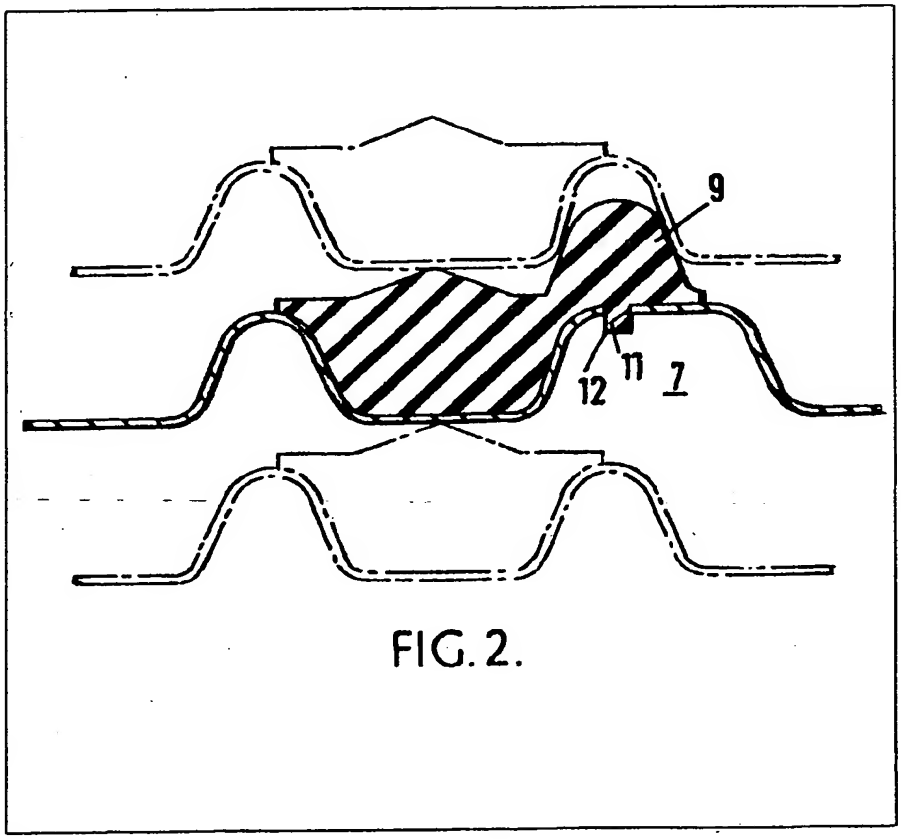

FIG. 2.

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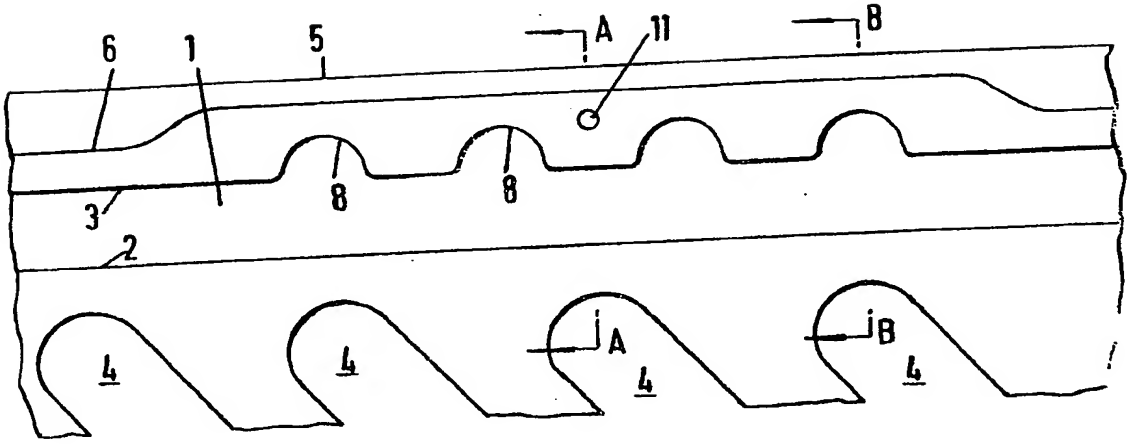

FIG.1.

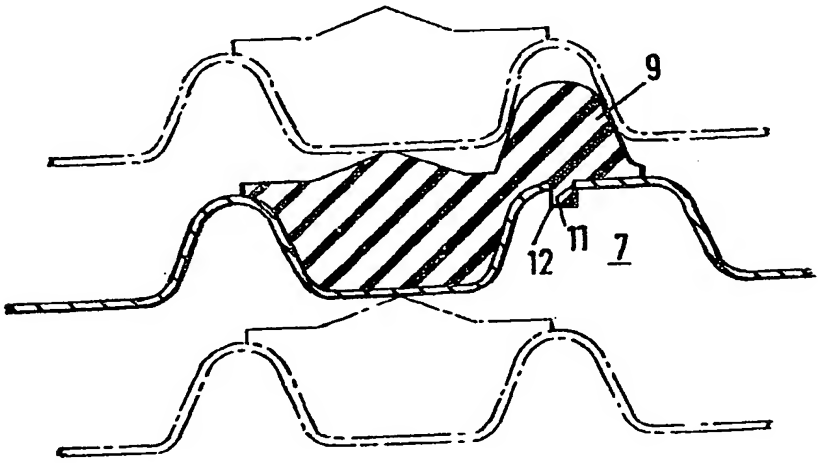

FIG.2.

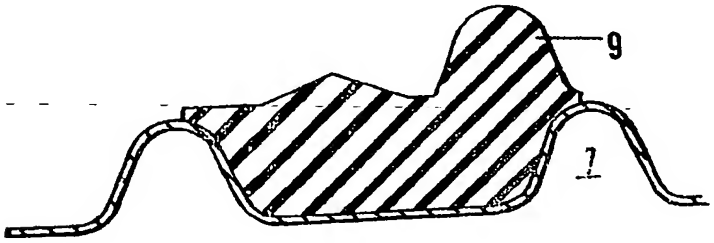

FIG.3.

SPECIFICATION

Improved heat transfer apparatus

This invention relates to plates for heat transfer apparatus, such as heat exchangers or evaporators.

In such heat transfer apparatus heat is transferred between two thin, broad streams, which may be both of liquid or one stream of liquid and one stream of vapour or two streams of vapour, or in some cases one or both streams may have mixed liquid and vapour phases. The streams are separated by plates assembled in a spaced face-to-face relationship to provide flow spaces between the adjacent faces of the plates. The boundaries of the flow spaces are enclosed and sealed by flexible or resilient gaskets surrounding the flow spaces between the adjacent faces and disposed between the flow spaces and entry and exit ports. The ports, in plate heat exchangers usually one at each corner of the plate, are similarly surrounded or part-surrounded by gaskets.

Each gasket is normally of a one piece construction set within a pressed groove formed in the plate. The manufacture of the gasket is normally carried out in moulds, but according to the size of the plate or the manufacturing techniques used the gasket may be assembled from two or more smaller components. The gaskets are normally moulded of an elastomeric material.

The sealing force against the fluid pressure in the flow space is obtained by compression of the gaskets in a direction normal to the plate surface and the resistance to gasket extrusion from the proper sealing position in the groove is normally enhanced by securing the gasket to the plate surface by the application of a system of adhesion. This system of adhesion is frequently complex and time consuming, involving the application of an adhesive to both the gasket and the plate surface, and assembly of the two components together. According to the system which is adopted it may be necessary to prepare the mating surface of either component before assembly and may be necessary to subject the assembled components to a process designed for curing the bond after assembly.

The foregoing description covers the initial manufacturing process. It is commonn practice that as the elastomeric gasket material hardens and deforms in use with the passage of time, the servicing of the plate heat exchanger at the user's factory requires the replacement of the gasket. Removal of the old gasket requires destruction of the adhesive bond and cleaning of the groove. Also, it is not always possible to subject the newly assembled gasket to the optimum process of adhesion such as would be applied during initial manufacture by the supplier.

In our patent application 7930054, published under No. 2028996, there is described and claimed a heat transfer plate having a gasket groove with a base and side walls, a compressible gasket mounted in the groove, the gasket being formed on its base with a series of spaced projections engaging in matching apertures in the base of the gasket groove.

By this means there is provided mechanical engagement of the gasket with the plate so that the necessity for a system of adhesion is avoided.

Our application indicates various possible locations for the projections.

Patent specification 1024977 describes a commercially successful form of plate heat exchanger comprising a plurality of plates, each having an interplate gasket housed in a generally peripheral recess, the outer wall of the gasket recess of at least one plate being folded to define a secondary recess along at least part of the length of the gasket recess, the said secondary recess opening in the opposite direction to the said gasket recess, a portion of the gasket housed in the gasket recess in the adjacent plate in the said opposite direction having a raised section located in the secondary recess to provide additional support for the gasket against the pressure in the flow space between the plates.

In particular, each plate is so formed that the gasket recess has alternating sections of equal length. In one set of sections the outer wall is folded to define the oppositely facing secondary recess and in the other set of sections the outer wall is intermittently outwardly displaced to widen the recess. The raised sections of the gasket are provided on those sections of the gasket corresponding to the set of sections of the recess along which the wall is outwardly displaced.

In seeking to arrange a mechanical engagement between the gasket and plate in an arrangement of this sort we have discovered that it is not necessary for the projections to be in the gasket base, but they may preferably be located below the raised section of the gasket to pass through apertures in the plate outside the portion of gasket recess of normal width in an intermittently widened section of the recess.

According to a first aspect of the invention there is provided a heat transfer plate having a gasket housed in a generally peripheral gasket recess being formed as alternating lengths of two formations, in one formation the outer wall being straight to provide a gasket recess of constant normal width and the wall being folded over to form an oppositely facing recess whereas in the other formation the outer wall is laterally undulating to provide intermittent widening of the recess from the constant normal width, the gasket fitting snugly in the recess and having in the

region of a laterally undulating length of the recess an upwardly protruding ridge adapted to match with the oppositely facing recess of an adjacent plate, the gasket being further provided in the region of the laterally undulating lengths with one or more projections passing through or engaging with matching apertures provided in the plate outside the normal width portions of the undulating gasket recess outer wall.

The invention further includes heat transfer apparatus comprising a pack of plates according to the invention as set forth above.

According to another aspect of the invention, there is provided a gasket adapted to fit a recess in a heat transfer plate, the said gasket having inner and outer generally parallel edges to abut the walls of the gasket recess, the gasket being formed of alternating lengths of constant width and variable width, with the variable width being formed by intermittent widening of the gasket by lateral undulation of the outer edge, the said lengths of variable width being further provided with an upwardly projecting ridge running parallel with the inner edge and located so as to bridge the wider portions of the outer edge, in which the gasket further has downwardly protruding projections formed beneath said ridge and adapted to pass through and engage in apertures formed in the plate outside the outer wall of the gasket recess.

The invention will be further described with reference to the accompanying drawings in which:—

Figure 1 is a plan view of a portion of a form of plate according to the invention, with the gasket omitted;

Figure 2 is a section on the line A–A of Fig. 1, also showing in phantom, portions of two adjacent plates; and

Figure 3 is a section on the line B–B of Fig. 1.

Fig. 1 shows a small area of a peripheral portion of a transfer plate, and more particularly a heat exchanger plate. A gasket recess is generally illustrated at 1 and has an inner wall 2 and an outer wall 3. Within the inner wall, the plate is provided with corrugations which are indicated at 4. Between the outer wall 3 of the gasket recess and the outer edge 5 of the plate, there is provided a downward fold 6 which gives rise to an oppositely facing recess 7 which can be seen in Figs. 2 and 3. It is to be noted that the gasket recess 1 is formed as alternating lengths of constant width in which the walls 2 and 3 are parallel, and length in which the outer wall 3 is displaced outwardly as indicated at 8 to provide lateral undulation or intermittent widening of the gasket recess. The effect of this can be seen in Figs. 2 and 3 where the centre plate in Fig. 2 is shown as having a normal width portion of the variable width length, while the upper and lower plates are shown as sectioned through their constant normal width gasket portions, with all the gaskets shown in their uncompressed form. It will be appreciated that the constant and variable width portions alternate round the periphery of the plate and the plates are so arrranged in the pack that they also alternate through the pack as indicated in Fig. 2. Fig. 3 shows a wider portion of the gasket taken at its maximum width. It will also be seen that in accordance with the arrangement described in patent 1024977, the gasket is provided with upwardly protruding ridges 9 along the lengths of variable width, and these ridges 9 project into the oppositely facing recesses 7 on the adjacent plates as indicated in Fig. 2.

In accordance with the invention, in order to avoid necessity for using adhesive to secure the gaskets to the plates, the plates are provided, outside the outer wall 3 of the gasket recess along the variable width portion thereof with apertures 11 (only one of which is shown in Fig. 1) located between two adjacent lateral undulations of the wall 3. In the arrangement illustrated, only one aperture 11 is provided on each variable width length, but more could be provided if required. As illustrated in Fig. 2, the gasket is provided with a projection 12 extending through and engaging with each of the apertures 11 so as to provide a mechanical connection between the gasket and the plate. It well be appreciated that the dimensioning of the aperture 11 and projection 12 is such that there is slight interference between the two so as to provide the mechanical retention but such that the gasket can be readily clipped into position and withdrawn.

Various modifications may be made within the scope of the invention.

CLAIMS

1. A heat transfer plate having a gasket housed in a generally peripheral gasket recess having an outer wall, the gasket recess being formed as alternating lengths of two formations, in one formation the outer wall being straight to provide a gasket recess of constant normal width and the wall being folded over to form an oppositely facing recess whereas in the other formation the outer wall is laterally undulating to provide intermittent widening of the recess from the constant normal width, the gasket fitting snugly in the recess and having in the region of a lateral undulating length of the recess an upwardly protruding ridge adapted to match with the oppositely facing recess of an adjacent plate, the gasket being further provided in the region of the laterally undulating lengths with one or more projections passing through and engaging with matching apertures provided in the plate outside the normal width portions of the undulating gasket recess outer wall.

2. A heat transfer aparatus comprising a pack of plates as claimed in claim 1, arranged

in a spaced face-to-face relationship.

3. A gasket adapted to fit a recess in a heat transfer plate, the said gasket having inner and outer generally parallel edges to abut the walls of the gasket recess, the gasket being formed of alternating lengths of constant width and variable width, with the variable width being formed by intermittent widening of the gasket by lateral undulations of the outer edge, the said lengths of variable width being further provided with an upwardly projecting ridge running parallel with the inner edge and located so as to bridge the wider portions of the outer edge, in which the gasket further has downwardly protruding projections formed beneath said ridge and adapted to pass through and engage in apertures formed in the plate outside the outer wall of the gasket recess.

4. A heat transfer plate substantially as hereinbefore described with reference to the accompanying drawings.

5. A gasket for a heat transfer plate substantially as hereinbefore described with reference to the accompanying drawings.

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